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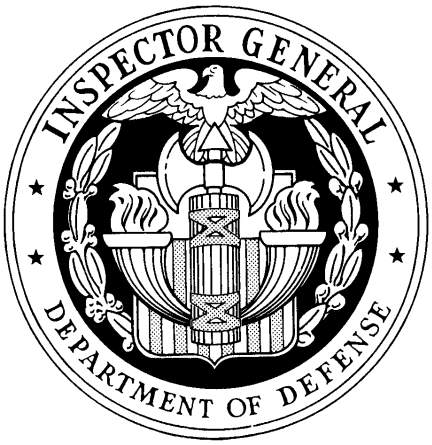

ON-BOARD JAMMERS FOR THE INTEGRATED DEFENSIVE ELECTRONIC COUNTERMEASURES

Report No. D-2001-086 March 20, 2001

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Abstract
The Integrated Defensive Electronic Countermeasures suite is intended to provide self-protection and increased survivability for tactical aircraft against radio frequency and infrared surface-to-air and air-to-air threats. The Navy-led program is designed to fill the electronic self-protection operational deficiency for the Navy F/A-18 E/F aircraft and will be integrated on the Air Forces B-1B and F-15 aircraft. The major hardware components to be developed are the AN/ALQ-214 radio frequency countermeasures system and the AN/ALE-55 Fiber Optics Towed Decoy. Total program cost is estimated to be $2.7 billion (then-year dollars). The AN/ALQ-214 development cost is $85.8 million and the procurement cost is $1.1 billion (458 units at $2.3 million each). The Navy plans to have an inventory of 366 radio frequency countermeasures systems and 10,980 decoys. The Air Force plans to have an inventory of 92 radio frequency countermeasures systems, 3,069 decoys for the B-1B, and 15,048 decoys for the F-15.

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Acronyms

ASPJ	Airborne Self-Protection Jammer
IDECM	Integrated Defensive Electronic Countermeasures

INSPECTOR GENERAL
DEPARTMENT OF DEFENSE
400 ARMY NAVY DRIVE
ARLINGTON, VIRGINIA 22202-4704

March 20, 2001

MEMORANDUM FOR NAVAL INSPECTOR GENERAL

SUBJECT: Audit Report on the On-Board Jammers for the Integrated Defensive Electronic Countermeasures (Report No. D-2001-086)

We are providing this report for review and comment. We considered management comments on a draft of this report when preparing the final report.

DoD Directive 7650.3 requires that all recommendations be resolved promptly. The Deputy Assistant Secretary of the Navy for Air Programs did not concur with Recommendation 2. Therefore, we request that the Deputy Assistant Secretary of the Navy for Air Programs provide additional comments on Recommendation 2. by May 21, 2001.

We appreciate the courtesies extended to the audit staff. For additional information on this report, please contact Mr. Charles M. Santoni at (703) 604-9051 (DSN 664-9051) (csantoni@dodig.osd.mil) or Mr. Robert L. Shaffer at (703) 604-9043 (DSN 664-9043) (rshaffer@dodig.osd.mil). See Appendix C for the report distribution. The audit team members are listed inside the back cover.

Thomas F. Gimble
Acting
Deputy Assistant Inspector General
for Auditing

Office of the Inspector General, DoD

Report No. D-2001-086 **March 20, 2001**
(Project No. D2000AL-0243)

On-Board Jammers for the Integrated Defensive Electronic Countermeasures

Executive Summary

Introduction. The Integrated Defensive Electronic Countermeasures suite is intended to provide self-protection and increased survivability for tactical aircraft against radio frequency and infrared surface-to-air and air-to-air threats. The Navy-led program is designed to fill the electronic self-protection operational deficiency for the Navy F/A-18 E/F aircraft and will be integrated on the Air Force's B-1B and F-15 aircraft. The major hardware components to be developed are the AN/ALQ-214 radio frequency countermeasures system and the AN/ALE-55 Fiber Optics Towed Decoy. Total program cost is estimated to be $2.7 billion (then-year dollars). The AN/ALQ-214 development cost is $85.8 million and the procurement cost is $1.1 billion (458 units at $2.3 million each). The Navy plans to have an inventory of 366 radio frequency countermeasures systems and 10,980 decoys. The Air Force plans to have an inventory of 92 radio frequency countermeasures systems, 3,069 decoys for the B-1B, and 15,048 decoys for the F-15.

Objectives. The overall objective was to evaluate the test planning and requirements for the AN/ALQ-165 and AN/ALQ-214 on-board jammers. We also reviewed the management control program as it applied to our audit objective.

Results. The Navy significantly reduced mission reliability from the level recommended in the cost and operational effectiveness analysis. The Navy reduced the requirements so that the AN/ALQ-165 Airborne Self-Protection Jammer, which the Navy plans to use in Block I of the Integrated Defensive Electronic Countermeasures Suite, could pass the operational test and evaluation and be installed on the F/A-18 E/F aircraft. Furthermore, the AN/ALQ-214, which will be the on-board jammer for Blocks II and III of the Integrated Defensive Electronic Countermeasures Suite will be tested against the same operational suitability requirements. By reducing the mission reliability rate, the Navy's logistical support requirement may have to be significantly increased in order to accomplish a 90 percent operational availability rate for the system. At the reduced mission reliability rate, unscheduled maintenance may be required up to 2.5 times more often than if the system met the mission reliability rate recommended by the cost and operational effectiveness analysis. Additionally, it is unclear whether the additional protection provided by the on-board jamming capability justifies the investment in the development, acquisition and logistical support. For details of the audit results, see the Finding section of this report. Management controls were adequate in that we did not identify any systemic management control weakness applicable to our audit objective. See Appendix A for details on the management control program.

Summary of Recommendations. We recommend that the Program Manager, Integrated Defensive Electronic Countermeasures, prior to proceeding with Block II of the Program, determine the logistics support cost to maintain the on-board jamming capability based on the results of the operational test and evaluation. We also recommend that the Program Manager reassess whether the on-board jamming capability provides an amount of added protection that justifies its development, acquisition, and logistical support costs.

Navy Comments. The Deputy Assistant Secretary of the Navy for Air Programs (the Deputy Assistant Secretary) nonconcurred with the finding, stating that the mission reliability requirement was based upon a systems engineering analysis; that current logistics cost requirements were based upon the system (including on-board jammers) as it was intended to be fielded; and that, as non-developmental items, the on-board jammers have minimal impact in terms of development, acquisition and logistics costs.

The Deputy Assistant Secretary agreed to review the logistics support costs in preparation for the Milestone III decision but did not agree to reassess whether the added protection provided by having on-board jamming capability justifies its development, acquisition and logistical support costs. The Assistant Secretary stated that cost versus benefit of on-board jamming capability was assessed by the Johns Hopkins University Applied Physics Laboratory in May 1999 and that another reassessment is not necessary. A discussion of the management comments is in the Finding section of this report, and the complete text is in the Management Comments section.

Audit Response. On January 19, 1995, the Johns Hopkins University Applied Physics Laboratory issued a cost and operational effectiveness analysis on alternative electronic warfare suites. The analysis recommended that the preferred alternative, regardless of whether that system utilized an on-board jammer, have a mission reliability requirement of 94 percent. The system being developed by the Navy does not meet that requirement. Furthermore, discussions with officials of the Office of the Deputy Chief of Naval Operations (Resources, Requirements, and Assessments) indicated that the Navy was aware that Block I of the Integrated Defensive Electronic Countermeasure (the Airborne Self-Protection Jammer and the existing AN/ALE-50 Towed Decoy) would be destined for failure if the system was required to meet a 94 percent mission reliability. We agree that using Airborne Self-Protection Jammer as the on-board jammer for Block I of the Integrated Defensive Electronic Countermeasure will have minimal impact in terms of development and acquisition costs. However, we disagree that development and procurement costs of AN/ALQ-214 for Blocks II and III of the Integrated Defensive Electronic Countermeasure are insignificant. The AN/ALQ-214 development cost is $85.8 million and the procurement cost is $1.1 billion (458 units at $2.3 million each). This represents about 44 percent of the $2.7 billion total program costs for the integrated defensive electronic countermeasure.

We consider the Navy statement that it will review the logistics support costs before the Milestone III decision to be responsive to the recommendation. The May 1999 analysis referenced by the Navy determined that, although the use of the towed decoy was the most effective alternative against threats, consideration should be given to using on-board transmitters in conjunction with the towed decoy system as part of the F/A-18 electronic warfare suite. However, the analysis did not address the cost versus the additional benefit that on-board transmitters would provide. Therefore, we request that the Deputy Assistant Secretary of the Navy for Air Programs provide additional comments by May 21, 2001.

Table of Contents

Background

In May 1992, the Director, Operational Test and Evaluation, assessed that the AN/ALQ-165 Airborne Self-Protection Jammer (ASPJ) was not operationally effective during operational test and evaluation. The Director, Operational Test and Evaluation, also assessed ASPJ as not operationally suitable because it did not meet required criteria for mission reliability or built-in-test effectiveness. Mission reliability is the probability that a system will perform mission-essential functions for a period of time under conditions stated in the mission profile. Built-in-test effectiveness is the probability that built-in-tests will correctly detect a fault, which minimizes the removal of components because of incorrect indications from the built-in-tests. On December 15, 1992, DoD canceled the ASPJ program and production was terminated.

After cancellation of the ASPJ program, the Navy conducted analyses that generated a requirement for a tactical aircraft self-protection capability against radio frequency and infrared surface-to-air and air-to-air threats. The Integrated Defensive Electronic Countermeasures (IDECM) Mission Need Statement discusses deficiencies in five areas:

- self-contained radio frequency self-protection,
- missile approach warning,
- infrared and ultraviolet expendables,
- integration of the subsystems of the self-protection suite, and
- identification of precise direction of radio frequency transmitters.

Development of the IDECM suite began in FY 1996 as an Acquisition Category II program. The IDECM program began as only an off-board jammer, specifically the Fiber Optic Towed Decoy, with a complementary on-board radio frequency jammer capability as a possible upgrade. The IDECM suite was intended to provide greater self-protection and increased survivability against a wider range of threats than an aircraft without self-protection or was equipped with existing countermeasures. The IDECM suite is a Navy-led program designed for the F/A-18 E/F aircraft to resolve the electronic self-protection operational deficiency. Portions of the suite will also be integrated on the Air Force's B-1B and F-15 aircraft. The major hardware components to be developed are the IDECM radio frequency countermeasures system (AN/ALQ-214) and the AN/ALE-55 Fiber Optics Towed Decoy.

Cost and technical issues have caused schedule delays in the IDECM program. To ensure that the initial deployments of the F/A-18 E/F aircraft have self-protection, the Navy decided to include an on-board radio frequency jammer in

the suite. The Director, Air Warfare Division, Office of the Deputy Chief of Naval Operations (Resources, Requirements and Assessments), added the requirement for on-board jammers to provide protection in the event that the three available towed decoys were expended or failed to operate. To reduce risk and to provide the electronic warfare protection, the Navy established a phased approach. Three sequential phases of on-board jammers and towed decoys were to be used.

- IDECM Block I would use the ASPJ and the AN/ALE-50 Towed Decoy. These are existing systems that the Navy would use until the AN/ALQ-214 could be integrated.
- IDECM Block II would use the AN/ALQ-214 and the AN/ALE-50 Towed Decoy.
- IDECM Block III would use the AN/ALQ-214 and AN/ALE-55 Fiber Optic Towed Decoy.

Our audit focused on the test planning and requirements for the ASPJ and AN/ALQ-214 on-board jammers.

The Navy plans to have an inventory of 366 AN/ALQ-214 systems and 10,980 AN/ALE-55 decoys. The Air Force plans to have an inventory of 92 AN/ALQ-214 systems, 3,069 AN/ALE-55 decoys for the B-1B, and 15,048 AN/ALE-55 decoys for the F-15. The prime contractor for the IDECM program is Sanders, and the total program cost is estimated to be $2.7 billion (then-year dollars). The AN/ALQ-214 development cost is $85.8 million and the procurement cost is $1.1 billion (458 units at $2.3 million each).

Objectives

The overall objective was to evaluate the test planning and requirements for the ASPJ and the AN/ALQ-214 on-board jammers. We also reviewed the management control program as it applied to the audit objective. See Appendix A for a discussion of the audit scope and methodology and the review of the management control program.

Operational Requirements of the Integrated Defensive Electronic Countermeasures Suite

The Navy reduced the mission reliability requirements from the level recommended by the cost and operational effectiveness analysis. The Navy reduced the requirements so that the ASPJ, which the Navy plans to use as the on-board jammer portion in Block I of the IDECM suite, could pass the operational evaluation and be installed on the F/A-18 E/F aircraft. Furthermore, the AN/ALQ-214, which will be the on-board jammer for Blocks II and III of the IDECM suite, will be tested against the same mission reliability requirements. By reducing the mission reliability rate, the Navy's logistical support requirement may have to be significantly increased in order to accomplish a 90 percent operational availability rate for the system. At the reduced mission reliability rate, unscheduled maintenance may be required as much as 2.5 times more often than if the system met the mission reliability rate recommended by the cost and operational effectiveness analysis. Additionally, it is unclear whether the additional protection provided by the on-board jamming capability justifies the investment in the development, acquisition and logistical support.

Evolution of the Integrated Defensive Electronic Countermeasures System

In the 1992 operational test and evaluation, the ASPJ was determined not operationally suitable because the ASPJ could not meet the requirement threshold for mission reliability and built-in-test effectiveness. Mission reliability is a measure of a system's operational effectiveness and is stated in terms of the probability of completing a specific mission profile or as a function of the mean time between operational mission failures. Built-in-test effectiveness is the probability of built-in-tests correctly detecting a fault. See Appendix B for more detailed information on the results of the ASPJ operational test and evaluation relating to mission reliability and built-in-test effectiveness.

Because the system did not meet operational suitability requirements, and did not meet the operational effectiveness requirement, the program was canceled and production was terminated. Termination of the ASPJ Program left the Navy with deficiencies related to tactical aircraft self-protection. On September 8, 1993, the Under Secretary of Defense for Acquisition (now Acquisition, Technology, and Logistics) informed the chairmen and ranking members of the Armed Services and Appropriations Committees of the Senate and House of Representatives of his intent to direct the Navy to conduct a cost and operational effectiveness analysis of the F/A-18 electronic warfare suite.

Cost and Operational Effectiveness Analysis. The Navy contracted with the Johns Hopkins University Applied Physics Laboratory to perform a cost and operational effectiveness analysis. The analysis was issued on January 19, 1995. The analysis addressed the first four deficiencies in the IDECM Mission Need Statement and evaluated four electronic warfare suite alternatives for the F/A-18 E/F. The analysis concluded that the electronic warfare suites that included a Fiber Optic Towed Decoy were the most effective suites. This analysis also showed that the Fiber Optic Towed Decoy without an on-board jammer was generally the most cost-effective suite and that it became more cost-effective as the threat environment increased.

Initiation of the IDECM Program. The IDECM Program began as an off-board jammer, specifically the Fiber Optic Towed Decoy, with a complementary on-board radio frequency jammer capability as a possible upgrade. The Operational Requirements Document, July 1, 1998, established mission reliability for the system at 94 percent, as recommended in the cost and operational effectiveness analysis. However, technical issues had stressed the program's schedule. System development was at a much slower pace than expected, leading to cost and schedule overruns. These technical issues included towline integrity of the Fiber Optic Towed Decoy, reliability of the decoy, and Improved Multi-Platform Launch Controller used to launch the decoys. To ensure that the initial deployments of the F/A-18 E/F aircraft had self-protection, the Navy decided to include an on-board radio frequency jammer in the suite. The Director, Air Warfare Division, Office of the Deputy Chief of Naval Operations (Resources, Requirements and Assessments), added the requirement for on-board jammers to provide protection in the event that the three available towed decoys were expended or failed to operate during a mission.

Cost and Operational Effectiveness Analysis Revisited. On May 20, 1999, the Johns Hopkins University Applied Physics Laboratory released an analysis entitled, "Use of On-board Transmitters with the Integrated Defensive Electronic Countermeasures System." The document reexamined the Milestone II cost and operational effectiveness analysis to determine whether the previous recommendations should be revised. The analysis determined that, although the use of the towed decoy was the most effective alternative against threats, consideration should be given to using on-board transmitters in conjunction with the towed decoy system as part of the F/A-18 electronic warfare suite. The analysis also noted that some assets were available from the terminated ASPJ production. On-board transmitters provide an additional capability to counter radio frequency guided missile threat when:

- the radio frequency of the threat is below that of the Fiber Optic Towed Decoy, but within that of the on-board system;
- the aircraft does not have a decoy deployed;
- a decoy fails and a new decoy has not yet become operational; and
- all of the decoys have been expended.

The cost and operational effectiveness analysis viewed the on-board jamming capability as a redundant system, intended to supplement the Fiber Optic Towed Decoy and not to be the primary system for providing electronic warfare protection. The cost and operational effectiveness analysis stated:

> Assuming that the aircraft survives but loses a decoy each time it is engaged, it will have lost all of its decoys by the end of the third engagement. If the aircraft has onboard transmitters, it will have some capability to counter subsequent threats with radio frequency countermeasures (RFCM). However, discussions with operational personnel during the COEA [Cost and Operational Effectiveness Analysis] indicated that they would most likely exit the threat area as quickly as possible after the first time they were engaged. This was partially driven by the fact that their tactic for defeating missiles in the endgame included a maximum-g maneuver. Because the aircraft is more maneuverable without ordnance, they would generally jettison their air-to-ground ordnance prior to performing the endgame maneuver. If the aircraft survives, there would not be any reason for the aircraft to continue its mission in the threat area other than to provide support for aircraft that had not jettisoned their ordnance. Thus, the probability that the aircraft would be engaged more than three times during a mission was minimal.

Addition of On-Board Jammer Capability. The Navy had about 40 ASPJs that could be used to provide electronic warfare protection for the F/A-18 E/F. The Navy considers the use of the ASPJ as an interim solution until Block II is implemented. The Navy established a phased approach to provide the electronic warfare protection for the F/A-18 E/F. Three sequential phases for deployment of on-board jammers and towed decoys were to be used.

- IDECM Block I would use the existing inventory of ASPJ and the existing AN/ALE-50 Towed Decoy until the AN/ALQ-214 could be integrated.
- IDECM Block II would use the AN/ALQ-214 and the AN/ALE-50 Towed Decoy.
- IDECM Block III would use the AN/ALQ-214 and AN/ALE-55 Fiber Optic Towed Decoy.

Block III supposedly will provide increased effectiveness through the use of integrated Fiber Optic Towed Decoy techniques and increased reliability and would be eventually replace the Block I and II configurations on the F/A-18 E/F aircraft.

Requirements and Test Planning for the Integrated Defensive Electronic Countermeasures System

Development of the Operational Requirements Documents for the On-board Jammers for IDECM. Operational testing was required before the Navy could obtain approval to install the ASPJ on the F/A-18 E/F aircraft as Block I of the IDECM Program. For the system to be tested, the Navy needed a test plan, which in turn required a Test and Evaluation Master Plan. Since the Test and Evaluation Master Plan establishes tests to determine whether the system satisfies criteria established in the Operational Requirements Document, the Navy wrote a new Operational Requirements Document that incorporated equipment that it owned and that had previously failed operational test and evaluation requirements in 1992.

Test Plan for the Operational Evaluation of the On-Board Jammers. Test Planning for the ASPJ and the AN/ALQ-214 on-board jammers to be used in the IDECM suite was extensive. A Test and Evaluation Master Plan was developed for each block of the IDECM suite. The IDECM Test and Evaluation Master Plan states that successful demonstration of the operational effectiveness and operational suitability requirements established in the On-Board Jammer Operational Requirements Document is required prior to fleet installation and deployment.

Operational Effectiveness. In May 1992, the Director of Operational Test and Evaluation assessed ASPJ as not being operationally effective because it did not meet the requirement threshold value for increasing the survivability of an F/A-18 strike force over that of a non-ASPJ baseline F-18 strike force. Although the requirements are not as stringent as those in the 1992 operational test and evaluation of ASPJ, the IDECM test plans require that the IDECM on-board jammers demonstrate that they are measurably more operationally effective than the AN/ALQ-126B on-board jammer and an aircraft without a self-protection capability.

Operational Suitability. The 1992 operational test and evaluation determined that the ASPJ was not operationally suitable because it could not meet the requirement thresholds for mission reliability and built-in-test effectiveness. The following table summarizes the reduction in requirements from the 1992 ASPJ Test and Evaluation Master Plan and the current Operational Requirements Document for IDECM. If the ASPJ had been tested against the reduced requirements, rather than the requirements it was tested against in 1992, the ASPJ would have been found to be operationally suitable and the program might not have been terminated.

Differences Between the 1992 ASPJ and IDECM On-Board Jammers Operational Suitability Test Requirements

Requirement	ASPJ	IDECM Onboard Jammers
Mission Reliability (percent)	95	86
Mean Corrective Maintenance Time for Operational Mission Failures (minutes)	45	120
Probability of Correct Detection (percent)	90	80
Built-in-Test False Alarm Rate	10 percent*	5 per 100 flight hours

*In the 1992 Operational Test and Evaluation, the 10 percent requirement for Built-in-Test False Alarm Rate equated to 2 incorrect removals per 100 flight hours.

A mission reliability threshold reflects the recommended operational level at which the aircraft's electronic warfare suite should perform in the threat environment. The Navy reduced the mission reliability requirement from 94 percent, as recommended in the cost and operational effectiveness analysis, to 86 percent in the Operational Requirements Document. The mission reliability requirement was reduced due to the inclusion of the improved multi-platform launch controller, launcher, on-board transmitters, and other aircraft hardware in scoring test failures.

The IDECM Program Management Office calculated that the reliability of the original configuration of the system could achieve the recommended 94 percent mission reliability threshold. This configuration comprised only the technique generator, fiber optic towed decoy, and a signal conditioning assembly. However, the independent testers of the system indicated that testing the reliability of only the off-board portion of the system would not accurately represent the mission reliability of the aircraft's electronic warfare suite. Therefore, additional components such as the on-board transmitter, the Improved Multi-Platform Launch Controller, and other components were included in the predicted reliability calculations. After incorporating those items into the reliability model, the predicted mission reliability of the aircraft's electronic warfare dropped below the 94 percent threshold. Discussions between the IDECM Program Management Office and the independent testers indicated that Block I of the IDECM program, as configured, would not pass if the system was tested against the mission reliability requirement of 94 percent. Subsequently, the Navy revised the mission reliability requirement in the revised Operational Requirement Document to reduce the mission reliability to

86 percent, which is a mean time between the operational mission failure requirement of 12 hours for the new configuration of the IDECM system. As such, the requirement in the Operational Requirements Document and test planning documentation represents what the entire system configuration must achieve under the independent testers scoring philosophy. Officials from the IDECM Program Management Office stated that the 86 percent requirement for mission reliability is not the performance level at which the system should perform if only essential countermeasure components, the AN/ALQ-214 and the AN/ALE-55 Fiber Optic Towed Decoy, were considered in scoring mission reliability.

The Navy also eased the requirement for built-in-test effectiveness for incorrect component removals caused by built-in-test fault indications in Blocks I, II, and III of IDECM to five removals for each 100 hours of flight time. In the 1992 operational test and evaluation, the ASPJ failed with two incorrect removals per 100 flight hours.

In addition to mission reliability and built-in-test effectiveness, the Navy changed the operational suitability requirement for mean corrective maintenance time for operational mission failures from 45 minutes to 2 hours. The IDECM Program Management Office stated that the requirement was changed due to the addition of hardware and in response to lessons learned from previous operational tests where support equipment used to troubleshoot failures increased the corrective maintenance time.

Test Requirements for the AN/ALQ-214 On-Board Jammer. The on-board jammer for the Block II and Block III versions of the IDECM suite, the AN/ALQ-214, will be tested against the same requirements used to evaluate the ASPJ in Block I testing. The AN/ALQ-214 design is based on the ASPJ design and has about 60 percent commonality with the ASPJ.

Effect of Reduced IDECM Mission Reliability. We were unable to determine any impact that the reduction in mission reliability would have on loss of aircraft. However, the reduction in mission reliability will have a significant impact on operations and maintenance costs.

Aircraft Attrition. The cost and operational effectiveness analysis released in January 1995 by the Johns Hopkins University Applied Physics Laboratory also examined the impact of reliability on the expected number of aircraft losses. The analysis showed that maintaining mean time between operational mission failures of 30 hours or higher produced no changes in predicted aircraft attrition rates. For a 1.8-hour mission, a mean time between operational mission failure of 30 hours equates to a mission reliability of 94 percent. The cost and operational effectiveness analysis stated that a significant increase in attrition of aircraft would occur if the mission reliability were less than 94 percent. However, discussions with officials at the Johns Hopkins University Applied Physics Laboratory indicated that a lower mission reliability would have a negligible effect on the attrition of aircraft. Using the

same formula, we analyzed the impact of an 86 percent mission reliability on the expected number of aircraft losses. The analysis showed that reducing the mean time between operational mission failures produced only slight changes in the predicted number of aircraft losses.

Impact on Logistical Support. The reduction in mission reliability will impact the logistical support for the IDECM. At an 86 percent mission reliability rate, or a mean time between operational mission failure of 12 hours, unscheduled maintenance may be required as much as 2.5 times more often than if the system met the recommended mission reliability rate. The Operational Requirements Document states that the objective value for mean time between operational mission failure is 150 hours. That value would be more in line with the mean time between operational mission failure for other countermeasure systems; however, we have not seen any progression towards measuring a higher mean time between operational mission failure for IDECM in the requirements or test planning documentation. An official at the IDECM Program Management Office detachment in Jacksonville, Florida, informed us that the AN/ALQ-126B on-board jammer, which the IDECM on-board jammers will be tested against, was achieving a mean time between failure rate of 223 hours. However, the official stated that the operational availability of the AN/ALQ-126B was 78 percent because they are only used if the fleet is going to combat. The AN/ALE-50 towed decoy requirement for mean time between operational mission failure that will be measured in the Block I Operational Test and Evaluation is 100 hours.

Although the Navy reduced the mission reliability of the IDECM, it kept the requirement for operational availability of the IDECM suite at 90 percent. Operational availability is the degree that equipment or weapons systems are expected to work properly. Operational availability is one of the key performance parameters in the Operational Requirements Document. Key performance parameters are those so significant that failure to meet the threshold value of performance can be a cause for the concept or system to be reevaluated or the program to be reassessed or terminated. Although the Navy might be able to accomplish a 90 percent operational availability in a short test period, we do not believe that the Navy will be willing to fund the additional maintenance actions and obtain the spare parts needed to keep the IDECM 90 percent operationally available if the system only has a mean time between operation mission failure of 12 hours. Accordingly, the Navy's logistical support requirement may have to be significantly increased to accomplish a 90 percent operational availability rate for the system. If the Navy does not provide the logistics support needed to accomplish a 90 percent operational availability rate, operational effectiveness of the IDECM system will be further reduced.

Test Results. We recognize that the mission reliability requirement defines the minimum acceptable performance standard. The mission reliability requirement neither predicts the actual system or component failure rates, nor determines the anticipated logistic support requirements. Failure rates are predicted based on analysis and testing of analogous systems and components, testing of actual

system hardware, and engineering estimates when appropriate. Those predicted failure rates are then used to determine the expected level of logistic support required.

Conclusion

Although the ASPJ Program was terminated 8 years ago, the Navy intends to use the ASPJ in Block I of the IDECM to satisfy the F/A-18 E/F requirement for self-protection capability against radio frequency and infrared surface-to-air and air-to-air threats. Even though the Navy reduced the mission reliability requirements established by the cost and operational effectiveness analysis, Block I of IDECM should provide the F/A-18 E/F with an amount of protection that is not otherwise available against the threat. Since Block I will use the existing inventory of ASPJ and AN/ALE-50 Towed Decoy, there will be no additional system procurement costs, only support costs.

However, the on-board jamming capability--the ASPJ and the AN/ALQ-214--are redundant systems intended to supplement the Fiber Optic Towed Decoy, not to be primary systems for providing electronic warfare protection. Given the reduced mission reliability rate, it is unclear how much more protection is being provided by these systems and whether the Navy will fund the additional logistical support costs.

Management Comments on the Finding and Audit Response

Navy Comments. The Deputy Assistant Secretary of the Navy for Air Programs (the Deputy Assistant Secretary) nonconcurred with the finding, stating that the mission reliability requirement was not reduced to allow the Airborne Self-Protection Jammer to pass the Operational Evaluation for Block I. The mission reliability requirement contained in the Operational Requirements Document for the Integrated Defensive Electronic Countermeasures was based upon systems engineering analysis.

The Deputy Assistant Secretary did not agree that the Navy's logistical support requirement might have to be significantly increased because of the reduction in the mission reliability requirement. The Deputy Assistant Secretary stated that current logistics cost requirements were based upon the system (including on-board jammers) as it was intended to be fielded.

The Deputy Assistant Secretary also did not agree that it was unclear whether the additional protection provided by on-board jamming capability justifies the investment in the development, acquisition, and logistical support. The Deputy Assistant Secretary provided circumstances under which on-board jammers are expected to improve survivability of the aircraft and stated that, as non-developmental items, the on-board jammers have minimal impact in terms of development, acquisition, and logistics costs.

For the full text of the Navy comments, see the Management Comments section of this report.

Audit Response. On January 19, 1995, the Johns Hopkins University Applied Physics Laboratory issued a cost and operational effectiveness analysis on alternative electronic warfare suites. The analysis recommended that the preferred alternative, regardless of whether that system utilized an on-board jammer, have a mission reliability requirement of 94 percent. The system being developed by the Navy does not meet that requirement. Furthermore, discussions with officials of the Office of the Deputy Chief of Naval Operations (Resources, Requirements, and Assessments) indicated that the Navy was aware that Block I of IDECM (the ASPJ and the existing AN/ALE-50 Towed Decoy) would be destined for failure if the system was required to meet a 94 percent mission reliability.

The Deputy Assistant Secretary did not address the increased logistical support requirement as a result of reducing the requirement, but rather the current logistics cost requirements now that the Navy has reduced the mission reliability requirement.

We agree with the Deputy Assistant Secretary, as stated in the report, that on-board transmitters would provide an additional capability to counter radio frequency guided missile threat in certain circumstances. We also agree that using the ASPJ as the on-board jammer for Block I of IDECM will have minimal impact in terms of development and acquisition costs. However, development and procurement of the AN/ALQ-214 for Blocks II and III of IDECM is significant. The AN/ALQ-214 development cost is $85.8 million and the procurement cost is $1.1 billion (458 units at $2.3 million each), which represents about 44 percent of the $2.7 billion total program costs for IDECM.

Recommendations, Management Comments, and Audit Response

We recommend that the Program Manager, Integrated Defensive Electronic Countermeasures, prior to proceeding with Block II of the Program:

1. Determine the logistics support cost to maintain the on-board jamming capability based on the results of the Operational Test and Evaluation.

Navy Comments. The Deputy Assistant Secretary concurred, stating that the Navy intends to review the logistics support costs in the normal course of preparing for the Milestone III decision planned for the third quarter of FY 2002. For the full text of the Navy comments, see the Management Comments section of this report.

2. Reassess whether the on-board jamming capability provides an amount of added protection that justifies its development, acquisition and logistical support costs.

Navy Comments. The Deputy Assistant Secretary nonconcurred, stating that the Johns Hopkins University Applied Physics Laboratory assessed the cost versus benefit of having an on-board jamming capability in May 1999 and that another assessment was not necessary. For the full text of the Navy comments, see the Management Comments section of this report.

Audit Response. The Johns Hopkins University Applied Physics Laboratory performed two cost and operational effectiveness analyses for IDECM. The January 1995 analysis concluded that the electronic warfare suites that included a Fiber Optic Towed Decoy were the most effective suites. That analysis also showed that the Fiber Optic Towed Decoy without an on-board jammer was generally the most cost-effective suite and that it became more cost-effective as the threat environment increased. The May 1999 analysis summarized the results of the January 1995 analysis as follows:

> Because the advantages of onboard transmitters were assessed to be somewhat limited and there was a significant cost increase associated with the addition of onboard transmitters, the COEA [cost and operational effectiveness analysis] recommended that the onboard transmitters should not be included in the basic EW [electronic warfare] suite.

The May 1999 analysis determined that, although the use of the towed decoy was the most effective alternative against threats, consideration should be given to using on-board transmitters in conjunction with the towed decoy system as part of the F/A-18 electronic warfare suite. However, the May 1999 analysis did not address the cost versus the additional benefit that on-board transmitters would provide.

Appendix A. Audit Process

Scope and Methodology

We reviewed documentation dated from May 1992 through September 2000. We used criteria in the DoD Regulation 5000.2-R to perform the audit. To accomplish the audit objectives, we took the following steps:

- determined that a valid requirement still existed for a replacement to the AN/ALQ-126B jammer;
- determined the users had approved the operational requirements;
- determined the IDECM program's operational test and evaluation included all of the system's operational requirements, as defined in the Operational Requirements Document; and
- reviewed management controls related to the audit objective.

Use of Computer-Processed Data. We did not use computer-processed data to perform this audit.

Use of Technical Assistance. We used mechanical and electronics engineers from the Technical Assessment Division, Office of the Inspector General, DoD, to assist us in analyzing and evaluating the operational suitability testing requirements for IDECM.

Audit Period and Standards. We performed this program audit from July 2000 through November 2000, in accordance with standards issued by the Comptroller General of the United States, as implemented by the Inspector General, DoD, and included such tests of management controls as deemed necessary.

Contacts During the Audit. We visited or contacted individuals and organizations within DoD. We also visited or contacted individuals and organizations at the Johns Hopkins University Applied Physics Laboratory. Further details are available upon request.

DoD-Wide Corporate Level Government Performance and Results Act Coverage. In response to the Government Performance and Results Act, the Secretary of Defense annually establishes DoD-wide corporate level goals, subordinate performance goals, and performance measures. This report pertains to achievement of the following goal, subordinate performance goal, and performance measure.

- **FY 2001 DoD Corporate-Level Goal 2:** Prepare now for an uncertain future by pursuing a focused modernization effort that maintains U.S. qualitative superiority in key warfighting capabilities.

Transform the force by exploiting the Revolution in Military Affairs, and reengineer the Department to achieve a 21st century infrastructure. **(01-DoD-02)**

- **FY 2001 Subordinate Performance Goal 2.4:** Meet combat forces' needs smarter and faster, with products and services that work better and cost less, by improving the efficiency of DoD acquisition processes. **(01-DoD-2.4)**

- **FY 2001 Performance Measure 2.4.3:** Successful Completion of System Operational Test and Evaluation (OT&E) Events. **(01-DoD-2.4.3)**

General Accounting Office High-Risk Area. The General Accounting Office has identified several high-risk areas in the DoD. This report provides coverage of the Defense Weapons Systems Acquisition high-risk area.

Management Control Program Review

DoD Directive 5010.38, "Management Control (MC) Program," August 26, 1996, and DoD Instruction 5010.40, "Management Control (MC) Program Procedures," August 28, 1996, require DoD managers to implement a comprehensive system of management controls that provides reasonable assurance that programs are operating as intended and to evaluate the adequacy of the controls.

Scope of the Review of the Management Control Program. In accordance with DoD Directive 5000.1, "Defense Acquisition," March 15, 1996, and DoD Regulation 5000.2-R, Mandatory Procedures for Major Defense Acquisition Programs (MDAPs) and Major Automated Information System Acquisition Programs (MAIS)," May 11, 1999, acquisition managers are to use program cost, schedule, and performance parameters as control objectives to implement the requirements of DoD 5010.38. Accordingly, we limited our review to management controls directly related to test planning of the IDECM.

In evaluating the management control process, we reviewed the risk-management program to determine the level of risk that the officials assigned to aspects of IDECM. We also reviewed the FY 1999 and 2000 Annual Statements of Assurance for the Navy to determine whether any weaknesses had been reported relating to the IDECM program. Because we did not identify a material management control weakness, we did not assess management's self-evaluation.

Adequacy of Management Controls. Management controls were adequate in that we did not identify any systemic management control weakness applicable to our audit objective.

Prior Coverage

During the last 5 years, no reports have been issued related to the test planning and requirements for the on-board jammers for the F/A-18 E/F aircraft.

Appendix B. Mission Reliability and Built-in-Test Effectiveness of Airborne Self-Protection Jammer

Mission Reliability

Mission reliability is a measure of a system's operational effectiveness and is stated in terms of the probability of completing a specific mission profile or as a function of the mean time between operational mission failures. For a given mission of time, mission reliability is calculated by taking the natural logarithm of the negative quotient of the mission of time divided by the mean time between operational mission failure. The mean time between operational mission failure is calculated by dividing the total system operating time by the number of operational mission failures. System operating time includes only the time the system is operating and being stressed under operational loads. It does not include standby time. For aircraft, system operating time is measured from the attempt to start the aircraft with the intent to perform a mission until shutdown. An operational mission failure is one that prevents the system from performing one or more mission essential functions. In the 1992 Operational Test and Evaluation of the ASPJ, the requirement for mean time between operational mission failure was 33.3 hours, which equates to a 95 percent mission reliability. In the test, the ASPJ was able to achieve 22.7 hours, a 92 percent mission reliability.

Built-in-Test Effectiveness

Built-in-test effectiveness is the probability of built-in-tests correctly detecting a fault. Built-in-test inadequacies were a significant factor in the ASPJ failing to meet mission reliability requirements in the 1992 Operational Test and Evaluation. The probability of built-in-tests correctly detecting a fault was 64 percent versus a criterion of at least 90 percent. The removal of components where built-in-tests incorrectly indicated that the component was faulty far exceeded the criteria of 10 percent. More than 48 percent of the components removed as a result of built-in-test fault indications were not actual failures. The ASPJ failed the operational test and evaluation with 2 incorrect removals per 100 flight hours. It was stated in the "Operational Test and Evaluation Report on the AN/ALQ-165 (V) Airborne Self-Protection Jammer (ASPJ)" December 4, 1992, that:

> ...at the organizational level, pilots and maintenance personnel cannot differentiate between an actual hardware failure or a software fault, including BIT- [built-in-test] related problems. The critical failure criterion could have been met if the false removals had not occurred.

Appendix C. Report Distribution

Office of the Secretary of Defense

Under Secretary of Defense (Acquisition, Technology, and Logistics)
Under Secretary of Defense (Comptroller)
    Deputy Chief Financial Officer
    Deputy Comptroller (Program/Budget)
    Director, Program Analysis and Evaluation
Director, Operational Test and Evaluation

Department of the Army

Auditor General, Department of the Army

Department of the Navy

Assistant Secretary of the Navy (Manpower and Reserve Affairs)
Assistant Secretary of the Navy (Research, Development, and Acquisition)
Chief of Naval Operations
Naval Inspector General
Auditor General, Department of the Navy
Program Executive Officer, Tactical Aircraft Programs
    Program Manager, Integrated Defensive Electronic Countermeasures

Department of the Air Force

Assistant Secretary of the Air Force (Financial Management and Comptroller)
Auditor General, Department of the Air Force

Other Defense Organizations

Director, Defense Contract Audit Agency
Director, Defense Contract Management Agency
Director, Defense Logistic Agency
Director, National Security Agency
    Inspector General, National Security Agency
Inspector General, Defense Intelligence Agency
Defense Systems Management College

Non-Defense Federal Organization

Office of Management and Budget

Congressional Committees and Subcommittees, Chairman and Ranking Minority Member

Senate Committee on Appropriations
Senate Subcommittee on Defense, Committee on Appropriations
Senate Committee on Armed Services
Senate Committee on Governmental Affairs
House Committee on Appropriations
House Subcommittee on Defense, Committee on Appropriations
House Committee on Armed Services
House Committee on Government Reform
House Subcommittee on Government Efficiency, Financial Management, and Intergovernmental Relations, Committee on Government Reform
House Subcommittee on National Security, Veterans Affairs, and International Relations, Committee on Government Reform
House Subcommittee on Technology and Procurement Policy, Committee on Government Reform

Department of the Navy Comments

DEPARTMENT OF THE NAVY
OFFICE OF THE ASSISTANT SECRETARY
RESEARCH, DEVELOPMENT AND ACQUISITION
1000 NAVY PENTAGON
WASHINGTON DC 20350-1000

16 FEB 2001

MEMORANDUM FOR THE DEPARTMENT OF DEFENSE ASSISTANT
INSPECTOR GENERAL FOR AUDITING

Subj: AUDIT REPORT ON THE ON-BOARD JAMMERS FOR THE INTEGRATED DEFENSIVE ELECTRONIC COUNTERMEASURES (PROJECT NO. D2000AL-0243)

Ref: (a) DODIG memo of 7 Dec 2000

Encl: (1) Department of the Navy Response

In response to reference (a), our comments are provided in enclosure (1). We concur with only one recommendation, but each finding and recommendation is addressed in the enclosure.

William A. Stussie
Deputy Assistant Secretary of the
Navy for Air Programs

Copy to:
NAVINSGEN (42)
COMNAVAIRSYSCOM (AIR-09G)

DEPARTMENT OF THE NAVY RESPONSE TO
DODIG DRAFT AUDIT REPORT OF 07 DECEMBER 2000
"ON-BOARD JAMMERS FOR THE INTEGRATED DEFENSIVE
ELECTRONIC COUNTERMEASURES"
(PROJECT NO. D2000AL-0243)

FINDING:

The Navy reduced the mission reliability requirements from the level recommended by the cost and operational effectiveness analysis. The Navy reduced the requirements so that the ASPJ, which the Navy plans to use as the on-board jammer portion in Block I of the IDECM suite, could pass the operational evaluation and be installed on the F/A-18 E/F aircraft. Furthermore, the AN/ALQ-214, which will be on the on-board jammer for Blocks II and III of the IDECM suite, will be tested against the same mission reliability requirements. By reducing the mission reliability rate, the Navy's logistical support requirement may have to be significantly increased in order to accomplish a 90 percent Operational Availability rate for the system. At the reduced mission reliability rate, unscheduled maintenance may be required as much as 2.5 times more often than if the system met the mission reliability rate recommended by the cost and operational effectiveness analysis. Additionally, it is unclear whether the additional protection provided by the on-board jamming capability justifies the investment in the development, acquisition and logistical support.

Department of the Navy Response:

We do not concur with the finding that the Navy reduced the Integrated Defensive Electronic Countermeasures (IDECM) mission reliability requirement to allow Airborne Self-protection Jammer (ASPJ) to pass the IDECM Block 1 Operational Evaluation. The IDECM Operational Requirements Document (ORD) mission reliability requirement was based upon a systems engineering analysis that is traceable to the total F/A-18E/F mission reliability requirement. Each system, including the AN/ALQ-214 (consisting of only the techniques generator, signal conditioning assembly, and towed decoy at the time) was allocated a reliability requirement that contributed to the total platform requirement.

While the IDECM program was being restructured in 1999, the Navy opted to include on-board transmitters in the AN/ALQ-214 system configuration. The selected acquisition strategy was to incorporate existing high and low band transmitters (ASPJ WRA 4 and WRA 5) into the AN/ALQ-214 as non-developmental items. A separate On-Board Jammer ORD was written to establish the requirements for the ALQ-214 system with the added transmitters. The mission reliability requirement was determined by applying the appropriate engineering analysis to the anticipated threat environment, the system configuration being developed, and the current operational test scoring philosophy. The final number does not pertain to just the on-board transmitters, but to the electronic warfare (EW) suite as a whole. This is a different number, developed under a different philosophy and different threat conditions, than that used in the ASPJ ORD.

ENCLOSURE (1)

Because the 1999 IDECM program restructure included a schedule adjustment that precluded use of the AN/ALQ-214 on the first several deployments of the F/A-18E/F, the F-18 community opted to equip the aircraft for those first deployments with in-stock Navy ASPJ units and ALE-50 towed decoys. This configuration, referred to as IDECM Block 1, was incorporated into the restructured IDECM acquisition plan as an interim solution. Because the ASPJ on-board transmitters and the AN/ALQ-214 on-board transmitters are the same WRA items, the Block 1 on-board transmitters were also evaluated against the requirements of the On-Board Jammer ORD.

We do not concur with the finding that the Navy's logistical support requirement may have to be significantly increased. The current logistics support cost requirements are based upon the ALQ-214 system (including on-board transmitters) as it is intended to be fielded. The logistics support cost is based upon a support analysis that uses the predicted system mean time between failures, component predicted mean time between failures, aircraft flight hours, and operational availability to determine the best maintenance solution at the lowest cost. These factors are also used to determine the sparing levels required for the system.

We do not concur with the finding that it is unclear whether the additional protection provided by the on-board jamming capability justifies the investment in the development, acquisition, and logistical support. The addition of on-board jammers are expected to improve survivability under three circumstances: (1) if the threat system is below the radio frequency (RF) coverage of the decoy, (2) if a decoy is not deployed during the engagement, and (3) during the time between when a decoy is destroyed by a missile and the next decoy is fully deployed and operating. As non-developmental items, the on-board transmitters have minimal impact in terms of development, acquisition and logistic support costs.

Department of the Navy Specific Comments:

Page 8, paragraph 6, Aircraft Attrition. We concur with the finding that reduction in mission reliability produces only slight changes in the predicted number of aircraft losses For the Cost and Operational Effectiveness Analysis (COEA), calculations were performed to assess the impact of EW suite reliability on aircraft attrition. Assuming that the aircraft would be in the threat envelope for 10 minutes, the expected attrition for 110 strike sorties (22 F/A-18E/Fs in the threat envelope over five successive strikes) for mean flight hours between critical failure (MFHBCF) of 10 to 250 hours was plotted. In this case, a critical failure meant that no RF energy was transmitted by the system. Examination of the resulting curve showed that at about 30 hours MFHBCF, the attrition curve starts to turn up and so the COEA stated "...no significant increase in attrition as long as the MFHBCF was greater than about 30 hours." However, even at 10 hours, the curve is not terribly steep. In fact, with these same assumptions, varying MFHBCF from 30 to 12 hours (reliability from 94% to 86%) changes the expected attrition for those 110 sorties from X to Y (NOTE: X and Y are classified numbers that may be provided upon contacting the IDECM Program Office). Although this is an increase of 7%, in terms of aircraft losses over the 110 sorties the actual number is quite small.

It should also be noted that the addition of the on-board jammers adds an alternate means of jamming in the event that a decoy is not operational. Although the reliability of the entire EW suite (on-board and off-board) may be less than what was recommended in the COEA, a failure in this case could mean that the system would be capable of transmitting from the on-board transmitters but not the decoy, or vice versa. Therefore, the expected attrition in the event of a failure would actually be less than the previous estimate.

Recommendations:

We recommend that the Program Manager, Integrated Defensive Electronic Countermeasures, prior to proceeding with Block II of the Program:

1. Determine the logistics support cost to maintain the on-board jamming capability based on the results of the Operational Test and Evaluation.

Department of the Navy Comments:

Concur with the intent of the recommendation. We intend to review the logistic support costs in the normal course of preparation for the Milestone III decision.

In accordance with the IDECM Acquisition Plan, ASN (RD&A) approved entry into Limited Rate Initial Production for the AN/ALQ-214 system in November 2000. Operational Test and Evaluation will begin in September 2001 to support a Third Quarter, FY02 Milestone III Decision. All appropriate acquisition data and documentation will be reviewed in preparation for this milestone decision.

The logistics support cost is based upon a support analysis that uses the predicted system mean time between failures, component predicted mean time between failures, aircraft flight hours, and operational availability to determine the best maintenance solution at the lowest cost. These factors are also used to determine the sparing levels required for the system. This analysis will be reviewed and updated as necessary in preparation for the milestone decision.

2. Reassess whether the on-board jamming capability provides an amount of added protection that justifies its development, acquisition and logistical support costs.

Department of the Navy Comments:

Do not concur. This issue was reassessed in the Johns Hopkins University Applied Physics Laboratory SECRET Report, VAS-99-022, "The Use of On-board Transmitters with the Integrated Defensive Electronic Countermeasures System (U)," 20 May 1999. We do not believe another assessment at this point is necessary. All appropriate acquisition data and documentation will be reviewed in preparation for the Milestone III decision, scheduled for Third Quarter, FY02. As non-developmental items, the on-board transmitters have minimal impact in terms of development, acquisition and logistic

support costs. The very low development cost of the on-board transmitter can not be broken out from other system development costs and has, for the most part, already been paid.

The addition of on-board jammers is expected to improve survivability under three circumstances:

1. The first occurs if the threat system is below the RF coverage of the decoy. The Surface-to-Air Missiles (SAMs) that currently operate in the lower RF range tend to be less sophisticated. Therefore, they can generally be defeated with a combination standoff jamming (EA-6Bs), maneuvers, and chaff. (The latter two may require some indication of missile launch.) In addition, the large size of their antenna make them less mobile and therefore better targets for lethal suppression. However, both of these limitations are being mitigated somewhat by upgrades to these SAMs and innovative ways of increasing their mobility, making the addition of on-board transmitters more beneficial.

2. The second benefit of on-board jammers is the protection that they provide during the time when there is no decoy deployed. This could be because of tactics; e.g., in low threat environments the aircraft may enable their on-board system once airborne but not deploy a decoy until there is some indication of hostility. In fact, for sustained operations such as no-fly zone enforcement, this tactic may actually save money because a decoy would not be used for each sortie. Of course, the risk associated with this tactic must be considered. The other situation where the on-board system is operational without a decoy is if all the decoys have been expended. For the tactics modeled in the COEA, it was unlikely that an aircraft would be engaged after it lost all of its decoys. Although the COEA accounted for decoys destroyed by missiles, it did not account for decoys lost because of burnoff. At the time of the COEA, this was not assessed to be a significant problem. Since that time, testing has shown that it could be a concern depending on the tactics employed. Therefore, the likelihood of an engagement after all of the decoys have been expended may be higher than assessed in the COEA, and the benefit of the on-board system in this case may be significant.

3. The on-board jammer may also provide benefit during the time between when a missile destroys a decoy and the next decoy is deployed and becomes operational. Although the deployment occurs relatively quickly, there may be some period of reduced protection while it is moving away from the aircraft if the missile that destroys the decoy is the first missile in a salvo. In this case, the on-board jammer may compensate for some of that reduced protection.

All of the above benefits are very difficult to quantify without assumptions and/or data on the likelihood of various events, e.g., the likelihood that a decoy will burnoff during some portion of a strike mission. In addition, recent conflicts have highlighted the high political costs associated with the loss of aircraft and pilots. These may far outweigh the associated economic or military costs. Therefore, the added protection provided by the on-board system may provide a valuable benefit that cannot be quantified.

Audit Team Members

The Acquisition Management Directorate, Office of the Assistant Inspector General for Auditing, DoD, prepared this report. Personnel of the Office of the Inspector General, DoD, who contributed to the report, are listed below.

Thomas F. Gimble
Mary L. Ugone
Charles M. Santoni
Robert L. Shaffer
Rebecca L. Deats
Gary D. Butler
Jaime A. Bobbio
Chandra P. Sankhla
Wei K. Chang
Jenshel L. Marshall
Krista S. Gordon